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ABSTRACT

A discussion of the role of educational technology (ET), particularly in second language teaching and learning, examines some theoretical foundations of ET and suggests why and how those foundations should be broadened. It first reviews the assets and shortcomings of three theories to which ET has been closely linked: behaviorism; neo-behaviorism; and cognitivism. It then examines two theoretical streams, the philosophical and humanistic, that could provide ET with a more humanistic dimension. This is followed by an analysis of three factors (political, educational, economic) that may influence any shift in emphasis in ET. It concludes that what is needed is: (1) a wider theoretical base for ET and (2) inquiry into and questioning of the influence of those who have heretofore legitimated educational decisions made about the use of ET. Contains 47 references. (MSE)

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"BROADENING THE EDUCATIONAL TECHNOLOGY FOUNDATIONS"

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"BROADENING THE EDUCATIONAL TECHNOLOGY FOUNDATIONS"

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ABSTRACT

This article suggests the reframing of the educational technology field to provide it with a less instrumental and more intersubjective perspective. The article looks at the shortcomings of some of the theories which have shaped the field of educational technology and proposes two solutions to handle those shortcomings: widening ET theoretical bases and questioning ET legitimacy. Two traditions, the philosophical and the humanistic are singled out to broaden the ET bases and create a synergistic model which may address different levels of knowledge and prevent reductionistic learning. A two-step quest of ET legitimacy is proposed which includes the inquiry of the agencies, political, corporate and educational, that legitimate ET decisions, and the inquiry of the dogmatic faith of those agencies' on the ET effectiveness and necessity.

Keywords: Educational technology, behaviorism, neo-behaviorism, cognitive psychology, philosophical tradition, humanistic tradition, computer-assisted instruction, computer-assisted language learning, CAI research, CALL research.

"BROADENING THE EDUCATIONAL TECHNOLOGY FOUNDATIONS"

INTRODUCTION

The field of educational technology (ET) has received different definitions ranging from those emphasizing the application of electronic aids to education (Leedham, 1973) to those stressing upon the system or process of instruction (Davies & Hartley, 1972).

Mainly concerned with the ET views which fit into the second of the aforementioned definitions, this paper revisits some of the theoretical foundations of educational technology and suggests why and how those foundations should be broadened. The paper begins by reviewing the assets and shortcomings of behaviorism, neo-behaviorist, and cognitivism, three theories to which ET has been, or is, closely linked. Next, the paper looks at two theoretical streams, the philosophical and the humanistic, which could provide ET with a more "humanistic" dimension. This is followed by an analysis of the stances of the three agencies, political, economic, and educational, which may decide on any ET foundational shift. The paper concludes with a summary of its suggested conceptual and contextual moves and their potential effects on the ET greater soundness.

THEORETICAL BASES

The main influences that have shaped the scientific interpretations of educational technology draw upon several streams of psychology of learning, namely, the behavioral, neo-behavioral, and cognitive traditions. A brief exploration of these traditions follows.

The Behavioral Tradition

The contemporary beginnings of ET can be attributed to the works of behavioral psychologists like Skinner (1953, 1968) whose theory of "operant

conditioning" advocates a stimulus response methodology for learning a carefully analyzed sequence of knowledge.

For educational purposes, behaviorism has found a framework in the organization or "systems approach" which implies: the setting of specific objectives; the determination of activities enabling the learner to attain the objectives; and the construction of measurement devices to determine if and how well the learner has met such objectives.

The pedagogical philosophy that evolves out of a systems behavioral design stresses two concepts: incremental learning and mastery learning. Incremental learning calls for an initial analysis of the subject matter into discrete learning units. Since one assumption of incremental learning is that an earlier step is prerequisite for a subsequent one, acceptable performance on each step is required before progressing to the next step in the sequence. The second concept, mastery learning, assumes that, given appropriate learning activities, all students can achieve mastery if they have enough time. This assumption results in the practice of continuous-progress learning where students proceed at their own pace, taking as much time as necessary, to meet the learning objectives.

Even if students with an analytical learning style would somewhat profit from this systems design, educational technology grounded on Skinnerian principles has been widely rejected. Its attempt to describe and explain learning solely in terms of efficient causes and other externalistic terms (conditioning, shaping, reinforcing, modeling) is no tenable.

The Neo-behavioral Tradition

Providing an alternative to behavioral doctrines, neo-behavioral technologists have subscribed to a learning model that reflects a distinct break with previous views of learning. Namely, the "information-processing" model of learning and memory described in such works as those of Anderson (1976), Gagné (1977) or Estes (1978).

According to Gagné's rendition of the model, human learning and memory can

be interpreted in terms of information processing. Simply put, the stimulation encountered by the learner is transformed or processed in a number of ways by internal structures (sensory registers, short-term memory, long-term memory, and response generators) during the period in which the change identified as learning takes place. Interestingly, Gagné's model includes Estes' (1972) concept of "expectancy," concept which maintains that the feedback effects of reinforcement influence learning and memory not because they are "rewarding" but because they convey information. By incorporating this concept, Gagné provides a novel interpretation of the important notion of "reinforcement" diametrically opposed to Skinner's (1968).

The adoption of the information-processing model of learning, noticeable either in courseware propositions (Lillie et al., 1989) or in programming language (Papert, 1980), is full of consequences for educational technology. Notably, the model provides new insights for the design of instruction in educational programs. It tells us that an act of learning, however brief or extended, is composed of several phases. Learning begins with the intake of stimulation from the receptors and ends with the feedback that follows the learner's performance. Instruction, then, is not a matter of presenting an initial stimulus; instead, it is composed of several different kinds of external stimulation that influence several different processes of learning.

Certainly, the information-processing model is significant in so that it sheds light into the dynamics of the learning process. However, if overestimated, the model can result in a display of disciplinary chauvinism on the part of technicians and logicians determined to demonstrate the supremacy of their "computer" schemata in the world of the intellect. As Roszak (1986) puts it,

> ...school may indeed be doing a great deal to help students to think like computers. In contrast, who will teach them to think any other way? Where, for example, will the cognitive style called art come in? (p. 83)

In the same way, claims like those arguing that the model can help train the mind to think clearly (Papert, 1980) are quite reductionistic; they seem to forget that thinking

means more significantly forming projects and reflecting about the values that the projects involve.

The Cognitive Tradition

Educational technologists concerned not only with learning processes but also with learning styles and abilities have subscribed to the tenets of well-established cognitive theories of learning, such as elaboration theory and discovery learning.

Ausubel's (1968) "elaboration theory" states that individual semantic networks are arranged hierarchically in a tree structure. That is, general concepts are broken down into more detailed concepts which are instantiated by more individual events or objects. Central to this theory are the notions of: "meaningful learning," which implies that information to be learned must somehow hook into relevant fields or schemata of one's existing cognitive structures; and "advance organizer," which refers to the pedagogical practice of helping learners activate and appropriate anchoring framework to aid subsumption of new learning.

"Discovery learning," on the other hand, is emphasized, among others, by Bruner (1966, 1977) and Landa (1974). Bruner, building on Piaget's (1954) theory of cognitive development,(1) observes that discovery learning can be a guided process as well as a free exploratory activity. As he puts it, "Mastery of the fundamental ideas of the field involves not only the grasping of general principles but also the development of an attitude toward learning and inquiry,...toward the possibility of solving problems on one's own" (1977: 20). From Bruner's perspective, learning a subject involves three almost simultaneous processes: acquisition of new information; transformation which comprises the ways we deal with information in order to go beyond it; and evaluation or checking whether the way we have manipulated information is adequate to the task. On his part, Landa (1974) suggests that cognitive learning requires discovery as well as the recognition and application of algorithms, rules and heuristic devices to cases or examples.

The above theories have had a major impact on educational technology. They

have been, for instance, invoked for courseware design guidelines (Jonassen, 1986) or embodied by research design projects (Sutherland & Knight, 1987) -- although in the latter of these instances, Bruner's cognitive development theories have been misinterpreted and converted on a close age-stage correlation

What Has Been Left Out?

Educational technology, understood as a systematic approach to learning and built upon the foregoing theories, has undoubtedly brought major benefits to education. It has served a useful purpose in increasing our understanding of the learning process and in stimulating an interest in the evaluation of instruction.

In spite of those benefits, ET is not without limitations. Through the way in which it has been defined over the last three decades, ET has introduced into educational thought and practice an element of organization skill, efficiency and economy of industrial production. As Travers (1973: 990) puts it, ET has become "...an extension of the machine's control over man that is evident in every factory;" and Kliebard (1971), Apple (1979), and Rowntree (1982) come up with similar conclusions. Moreover, the emphasis on formal organization and efficiency has lead to other ET shortcomings, namely, the reification of knowledge and order, and the disregard of feelings or aesthetic education because of an exclusive emphasis on cognitive skills.

Adding to the above limitations, there is a labyrinth of controversial issues which, although already remarked almost two decades ago (Knapper, 1980), haven't been fully unraveled yet. Those issues include, among others:

a. The redefinition of the teacher's role. Even if largely emphasized by ET proponents (Rowntree, 1982), the shift of the roles from the teacher's transmitter of knowledge to the teacher's facilitator of learning hasn't fully materialized.

b. The long-term effects of technology-based education on students' attitudes and behavior.

c. The potentially detrimental effects of the ET-related learning systems built

around discrete and quantifiable units of information on students' creativity.

d. The implications of ET for the larger educational enterprise and for the society as a whole, especially the issue of whether greater use of technology may lead to the standardization of educational products and messages.

Addressing the above limitations and issues would certainly imply the remodeling of ET conceptual and contextual bases. In line with this assertion, the following section will provide some personal insights about how and why such a remodeling should be done.

RETHINKING CONCEPTUAL AND CONTEXTUAL BASES

Certainly, systems design and cognitive processes have provided ET with that dose of rationality and, therefore, of restrictiveness which, as pointed out elsewhere (Doll, 1989; Slaughter, 1989), characterizes modernist educational models. Thus, if ET is to be put into a less rational, more human framework, its theoretical bases should be broadened and the legitimacy of its agencies and discourses should be questioned.

Looking for ET Broader Foundations

Educational technology should find further grounding on two theoretical traditions, the philosophical and the humanistic, which deal with important values of the "personal," like spontaneity, creativity and responsibility.

Among the theorists of the philosophical tradition, Habermas (1971) contends that it is a mistake to assume that the mode of inquiry derived from what he calls the "instrumental domain" of learning is equally appropriate for other domains like the "social-communicative" and the "emancipatory/self-reflective." Building upon Habermas' views, Mezirow (1981) argues that the emancipatory/self-reflective domain involves the process of becoming critically aware not only of habits of perception, thought and action but of the "cultural assumptions governing the rules, roles,

conventions and social expectations" (p. 13). Such a process, which Mezirow calls "perspective transformation," constitutes for Freire (1970) a form of social consciousness raising that liberates and leads to praxis.

As far as the humanistic tradition is concerned, psychologists, such as Maslow (1954) or Rogers (1969), have also emphasized reflection on attitudes, values, and aspirations through human interaction as an essential domain for learning.

Because the philosophical and the humanistic traditions have a common focus on concepts such as praxis (unity of reflection and action) and dialogue (place where praxis occurs), they could give ET the ability to reconcile science and "human meaning" (Ferré, 1988). Endorsing such traditions, although already advocated (Deshler & Gay, 1986), is not an easy task, especially, because their underlying philosophies conflict with those grounding current ET conceptualizations. Even so, a dialogue among the different traditions should be established so that a synergistic, rather than a competitive, model could emerge. A model which would address different levels of knowledge and feature a built-in opposition to reductionism. Eventually, this would be a model which, moving beyond narrow and instrumental perspectives, would allow the exploration of the richer and more complex world of human intersubjectivity.

Questioning the ET Legitimacy

As important as the move beyond theoretical reductionistic positions could be, the inquiry of ET legitimacy becomes essential because it is in the destabilization of this legitimacy which lies the possibility of any theoretical move. Such an inquiry should target both the legitimating agencies and their discourses.

Legitimating agencies

In the context of educational technology agencies, three major partners--political power, industry and higher education--appear to be the driving forces behind interest in ET implementation.

As far as the first of these partners is concerned, and even if disagreeing with the radicalism of some skeptical opinions about the issue (Lyotard, 1988), it seems that power rather than claimed concerns of "high quality education" motivates the political interests on ET (Knapper, 1980).

Regarding the second of the ET agencies--industry--it is also clear that corporate involvement on ET growth is geared towards profit interests. Grounding this assertion, Komoski (1987) provides evidence of the breadth and monopoly of some leading corporations interested in the development of ET-related products. Similar denunciations can be heard from Roszak (1986) or Hirvela (1989: 64) who observes that: "Where there are programs to be marketed, there surely are large computer corporations somewhere on the scene. And these corporations are currently locked into fierce competition over the vast profits to be made from the immensely lucrative school market."

Finally, there is a third partner, higher education institutions, which is bound to play a pivotal role if a different ET with an agenda of values counting for more than political or economic interests is to emerge.

A closer look at this agency and its role vis-à-vis of ET reveals its lack of autonomy and suggests its alliance with other "interest-free" partners. Indeed, higher education institutions are quite dependent on ET matters. Such institutions become "...a subsystem of the social system," as observed by Lyotard (1988: 48), or the "subsidiaries" of industry's corporations, as meant by Roszak (1986) when he says: "There is another tempting proposition that helps ease the universities toward full computerization. Schools and the manufacturers may go into business together" (p. 58).

This lack of autonomy is noticeable on the many distorted discussions about ET and higher education agencies, like the one below, which draws upon both the language and imagery of the marketplace:

> Today's schools, however, are inadequate to the task of preparing individuals for the emerging age in which the

> nature of work, production, and social interaction will be completely different, with more emphasis on organizations and milieus characterized by entrepreneurial behavior...and "networked" decentralized decision making. (Razik & Nalbone, 1990: 67)

Therefore, and at the risk of sounding idealistic, higher education should stay away from the political and economic agencies and, especially, distrust those "altruistic" discourses of education-industry compromise (Useem, 1986) for ET advancement's sake. Only by regaining its "freedom" would higher education become the independent observer that could help to reinterpret ET in light of genuinely pedagogical interests.

In this emancipatory quest, higher education should, therefore, look for alternative "allies" (educationalists) and alternative scenarios (educational arena). Indeed, a constructive confrontation could be established between the "first hand" ET experiences of practicioners, and the theories and empirical research furnished by university talent on the other. Such a confrontation could lead to the materialization of some justified claims in favor of a greater protagonism of pedagogical practice. Claims like those of curricularists (Doll, 1990), emphasizing that "Any theory we develop should emerge from and be centered around the practical." (pp. 14-15) or claims of language theorists (Ellis, 1988), saying that "Applied research is always likely to be more productive, educationally, than research applied." (p. 10).

Legitimating discourses

Two arguments, "effectiveness" and "necessity," are frequently invoked by the aforesaid agencies to justify ET, understood as the instructional application of technological tools.

Effectiveness. A closer look to the argument of the effectiveness of educational technology reveals that it is value-laden: As said in previous pages, by betting on the sole criterion of effectiveness other relevant parameters, like truth, justice, or beauty, seem to be ignored. Moreover, such a criterion is weakly rooted because first it builds upon insufficient, inconclusive, and/or biased research; and second it builds

primarily upon "packageable" knowledge.

The number of relevant research studies in the field is relatively small (Kotlas, 1997), and so is the number of researchers who conduct them (Miech, et al., 1996).[2] Moreover, results of that research are mixed. Some CAI (Computer Assisted Instruction) research reviews (Roblyer, Castine & King, 1988;[3] Miech et al., 1996), show that computer applications have a statistically significant positive effect in a majority of the areas examined. Other reviews (Rusell, 1997),[4] however, demonstrate that there is no significant difference no matter what media one uses for learning.

In the same way, it seems that research has been beset by a number of socio-institutional factors, like those pointed out by Knapper (1980), and exemplified elsewhere (Cradler, 1997), which include: a) expectancy and social desirability (e.g., students, instructors, and administrators may view technological approach to teaching through rose-tinted spectacles); b) selection of inappropriate or misleading evaluation criteria (e.g., estimates of costs of instructional technology are often hedged around with unrealistic qualifications concerning the extent of use of the system); and c) inappropriate interpretation of research results (e.g., faulty results can be found when comparing the effectiveness of teacher-led instruction vs technology-enhanced instruction because of the greater variability in the former, due to teaching styles differences, than in the latter).

Referring to the knowledge which sustains the criterion of effectiveness of education technology, it reduces to the one which can resist an information-processing treatment. A knowledge which drawing exclusively on rationality can curtail the freedom of thought of individuals by propagating a one-dimensional representation of reality. As Lyotard (1988: 4) observes: "Along with the hegemony of computers comes a certain logic, and therefore a certain set of prescriptions determining which statements are accepted as 'knowledge statements'."

To correct the detected weaknesses of the research which supports the effectiveness of ET, and thus its legitimacy, two initiatives could be taken: First,

research on the field should be increased, and questions like "Can instructional technology be said to be an effective way of teaching?" should be replaced with "Under what circumstances can particular technologies (or combination of them) work best for particular types of students?" Second, even if difficult because hardly measurable, research should target those ET applications dealing with the communicative/self-reflective domains of learning. Only then could institutional claims of ET effectiveness be fully grounded.

Necessity. A second argument of the agencies in favor of ET is that "educational technology is a must for the next generation of 'computerized' people." Making ET dependent upon the societal implications of the emergent technological change is not a tenable argument. First, because the future is not a "safe value," it would be unwise to put too much faith in futurology. Certainly, ET can help shaping the horizon of educational expectations but it cannot fix it once and for all, especially when current theoretical movements away from rigid dogmatisms emphasize the provisionality of knowledge (McCracken, 1989) and redefine the curriculum as a "process of personal transformation" (Doll, 1990: 512).

Second, the horizon of educational expectations cannot be predicted neither across the time, as we have said, nor across the space. The successful transfer of ET models from "highly developed" to "developing" countries cannot be taken for granted. As observed elsewhere (Hawes, 1980; Le Mon, 1988), important concerns stemming from cultural differences among human beings arise that should be thought of in transfer decisions. For instance, while occidental cultures rely upon the written tradition, and thereby computerization, there are other cultures in which oral tradition, and thereby the power of language, play a role in the dissemination of skills and ideas. Also, not all cultures share the reverence for speed and efficiency which identifies computer-literate cultures.

The above questioning of the ET agencies, although seemingly dismissing, turns out to be positively constructive. Indeed, if educational technology is to be propelled with strong gusts of humanism, the propellants (educational theorists and

practitioners) should be able to recognize the makers of the current ET discourses and to interpret the narratives underlying such discourses.

CONCLUSION

If it is true, as Jenks observes, that "...all propositions of truth are time- and context-sensitive" (1989: 59), it follows that the "truth" of curricular alternatives like the one proposed by educational technology cannot evade this rule. Therefore, and in an attempt to promote awareness of how ET conceptual and contextual variables may determine ET tendencies to freedom or coercion, this paper has addressed the ET issue in terms of theoretical assumptions and driving institutional agencies.

In this way, the paper has concentrated on some main traditions which have shaped ET (behaviorist, neo-behaviorist, cognitive). And attention has been paid to the strengths of such traditions (e.g., greater emphasis on the evaluation of instruction and on the learning processes) as well as their limitations (e.g., fading of the teacher's role, overlooking of learner's skills such as creativity, and normalization of learning products).

To handle the shortcomings of these foundations, two solutions, wider theoretical bases and ET legitimacy inquiry, have been proposed. Regarding the first solution, two traditions, philosophical and humanistic, and their main underpinnings, focus on self-reflective/communicative learning, have been highlighted. Also, advice has been provided about why these traditions should complement, rather than replace, those neo-behaviorist or cognitive ones, the strengths of the former accounting for the deficiencies of the latter.

Referring to the second solution, a two-step quest has been proposed. First, the inquiry of the agencies which legitimates ET decisions (political powers, corporate industries and higher education), inquiry which has lead to the stance for a greater protagonism of the higher education agency and its wider dialogue with educators. Second, the questioning of the dogmatic faith and inflated expectations of the agencies

in the effectiveness and future protagonism of ET: faith and expectations which seem to overlook some main drawbacks like the curtailing of knowledge, or the cultural barriers which impede the transfer of ET systems.

All in all, implicit in what has been said is that educational technology and its key word, practical knowledge, cannot certainly be dismissed in an advanced, rapidly changing technological society like ours. However, it should give room to other essential terms like: "creativity" for using basic skills once acquired, and "inner growth," which supposes the affirmation of student's identity and the liberation from the narrow and parochial aspects of such an identity.

NOTES

(1) According to Piaget's theory of "cognitive development," the process of learning reflects how a child develops strategies for dealing with the environment. Important in this theory is: First, that children change as they develop through four stages ("sensorimotor", "preoperational," "concrete operations," and "formal operations"); and second, and more important, that children change not only in what they learn but in how they learn.

(2) Miech and his colleagues examined 22 empirical CALL studies published between 1989 and 1994, and 13 reviews and syntheses published between 1987 and 1992. The authors observed that much of the research they reviewed was conducted by two groups "(1) a relatively small group of researchers whose names appear repeatedly in the literature, and (2) a group of graduate students writing their theses in the subject. Given the potential importance of CALL in colleges and universities, we wonder if the responsibility for CALL research should continue to fall on few shoulders" (1996: 52)

(3) Roblyer et al. (1988) review CAI studies between 1980 and 1987. Findings of the review include, among others, the following: a) computer applications seem to have greater effects at college and adult levels than at elementary and secondary levels; b) computer applications appear to have slightly greater effects with mathematics than with reading/language skills; c) computer applications do seem to significantly improve students' attitudes toward school and subject matter. However, to date, insufficient data exists to indicate that better attitudes have any impact on achievement.

(4) Russell (1997) has built an open-ended bibliography of 248 research reports, summaries, and papers from 1928-1996 that demonstrates the non significant impact of media types on learning. Russell's bibliography reminds the profession that the comparative impact of the technologies remains of paramount importance.

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